In the Specification:

Please delete pages 1 and 2.

On Page 3, delete the drawing image and the image of the Abstract.

Please delete pages 11 - 14.

On page 8, insert a page break after “limited to these embodiments”

Please amend the Specification text from page 3, “The invention relates …” to page 8, “limited to these embodiments”, as follows:

~~The invention relates to a vehicle axle system for an agricultural or industrial utility vehicle. The vehicle axle system has a moving—preferably oscillating—supported vehicle axle, wherein at least two wheels can be attached to the vehicle axle so that they can rotate. A torque tube is provided, which can be connected on one end to a vehicle frame and on the other end to the vehicle axle for supporting the axle suspension. On the vehicle axle there is at least one electric drive, with which at least one wheel attached to the vehicle axle can be driven. Furthermore, the present invention relates to a torque tube, which can be connected on one end to a vehicle frame and on the other end to a vehicle axle for supporting the axle suspension. In addition, the present invention relates to a vehicle axle, which can be installed on a vehicle so that it can move, and is preferably supported so that it can oscillate, and to which at least two wheels can be attached so that they can rotate. The present invention also relates to a vehicle, especially an agricultural or industrial utility vehicle.~~

VEHICLE AXLE SYSTEM

Field of the Invention

The present invention relates to a vehicle axle system for an agricultural or industrial utility vehicle.

Background of the Invention

Vehicle axle systems ~~of the type named above have been~~are known ~~for a long time~~ from the state of the art. For example, ~~from~~ EP 0 913 280 A1~~,~~1 shows a vehicle axle system ~~is known,~~ in which the front axle is attached to a torque tube for supporting the axle suspension. One end of the torque tube is connected to the vehicle frame via a ball- and- socket joint. The other end of the torque tube is fixed rigidly to the front axle. The front axle is supported so it can oscillate. The torque tube ~~is used in the commercial vehicle known from EP 0 193 280 A1—which is embodied in the form of a farming tractor—for supporting~~supports the front axle in the vehicle longitudinal direction. Very generally, the torque tube is also called a tie member or torque connecting rod. The torque tube typically holds a drive shaft, which transfers at least part of the torque generated by an internal combustion engine to the wheels ~~allocated to~~on the ~~vehicle~~ axle~~—optionally~~, such as via a differential transmission. Thus, the torque tube ~~is used on one hand for supporting~~supports the suspension of ~~a vehicle~~the axle and ~~on the other hand for protecting~~protects a drive shaft ~~running~~which runs inside ~~this~~the axle.

Furthermore, ~~from~~ DE 196 23 738 A~~1, a commercial~~1 shows vehicle~~ is known,~~ which can have a front axle with electric single wheel drives. Here, the wheels of the front axle are driven via a cardan shaft by an internal combustion engine and/or by the electric drive via a pick- off gear~~, wherein the~~. The drive power of the cardan shaft and that of the electric drive can be delivered to the wheel via a pick- off gear. In this way, a continuously variable adaptation of the rpm values of the individual wheels of the front axle is possible, which allows this vehicle to be used for multiple purposes.

~~Now the~~The electric drives on the ~~vehicle~~ axle could be connected to a generator in the vehicle through flexible electric line connections. Disadvantages ~~here~~ are that such flexible electric lines can be damaged~~, in particular by martens,~~ during ~~the~~ use of the ~~commercial~~ vehicle or in the power- off state.

Summary of the Invention

~~Therefore, the present~~Accordingly, an object of this invention is ~~based on the problem of providing and improving a~~to provide an improved vehicle axle system~~, a vehicle axle, a torque tube, and a vehicle of the type named above, through which the previously mentioned problems can be solved. In particular, the electric drives should be~~.

A further object of the invention is to provide such a vehicle axle system which has electric drives powered with electric current~~, so that the relevant~~ over power lines which cannot be damaged under normal conditions .

~~The problem is solved according to the invention by the teaching of Claim 1. Other advantageous configurations and improvements of the invention result from the subordinate claims. According to the invention,~~These and other objects are achieved by the present invention, wherein a vehicle axle system ~~of the type named above is characterized in that~~has electric drive components ~~for the electric drive~~which are provided on ~~the~~a torque tube.

The vehicle axle system has a supported moving, preferably oscillating vehicle axle, with wheels rotatably attached to the axle. A torque tube is connected on one end to a vehicle frame and on the other end to the vehicle axle for supporting the axle suspension. The wheels are driven by an electric drive on the axle.

~~According to the invention, first it has been recognized that especially electric~~Electric power lines can be guided from a generator or power- supply system in the vehicle via the torque tube to the vehicle axle, especially running inside the

torque tube, so that the electric lines are protected from external influences from the vehicle to the moving vehicle axle. Thus, the electric power lines must not be laid, for example, along a hydraulic cylinder, which connects a vehicle frame to the moving vehicle axle system, where the electric power lines would not be protected from external influences. Therefore, the electric components for the electric drive are preferably arranged in the torque tube. ~~In this respect, in addition to the existing functions—supporting~~ Thus, the torque tube not only supports the axle suspension and ~~protecting~~protects an optional mechanical drive shaft~~—the torque tube takes on another function, namely the guidance and protection of~~, it also guides and protects electric connecting lines or ~~very generally the protection of~~ electric components.

~~Now, the~~The torque tube ~~could~~may have an essentially circular, oval, or polygonal cross section. Along its longitudinal direction, the torque tube could be conical, wherein the part of the torque tube facing the vehicle axle system could have a larger cross section than the part facing the ~~commercial~~ vehicle frame. Optionally, an elongated indentation could be provided in the torque tube, in which electric power lines are arranged. In this case, the corresponding electric components are arranged on the outer region of the torque tube~~—~~, but protected by the indentation. Preferably, the torque tube can be assembled from several parts and ~~embodied, in particular,~~be modular. Thus, a part of the torque tube could have an essentially U- shaped cross section, on which the other part of the torque tube can be mounted, which could have an essentially flat shape. Such a configuration of the torque tube enables simple assembly of the electric components arranged inside the tube. As long as the torque tube is also formed in a modular way, it can be assembled from individual modules.

~~In a preferred embodiment~~Preferably, the electric components in the torque tube could ~~have~~include at least one power electronics component. With such a power electronics component, for example, the magnitude of the electric power delivered to the electric drive could be controlled. Alternatively or additionally ~~to the arrangement of a power electronics component in the torque tube~~, at least one power electronics component could be arranged on the vehicle axle, wherein this power electronics component could fulfill a comparable function.

In a similarly preferred embodiment, the electric components on the torque tube could ~~have~~include a frequency converter. ~~In principle, the~~ The electric current for the electric drives would be generated with the help of a generator. Typically,

such a generator is driven by the ~~internal combustion engine of the commercial~~ vehicle engine. However, because the ~~internal combustion~~ engine has a variable rpm depending on the driving situation of the ~~commercial~~ vehicle, the electric current generated by the generator has a variable frequency. Such a frequency converter could be used for converting the electric alternating current of variable frequency into an electric alternating current of a given, essentially constant frequency. With the frequency converter, the electric alternating current of variable frequency generated by the electric generator could first be converted into direct current and then into alternating current of a given frequency. The electric drive, which is preferably embodied as an asynchronous motor, could then be driven with this alternating current.

In a preferred embodiment, the electric components in the torque tube could ~~have~~include a braking resistance. Such braking resistance could be used for braking with the wheels of the vehicle axle system, namely when the electric drives in the vehicle axle system are operated in generator mode. As soon as the electric drives are operated in generator mode, these generate electric current, which could be fed, for example, to the braking resistance or to another electric load. In this way, the electric drives generate a braking torque, which could be used, for example, when the ~~commercial~~ vehicle is driving downhill with long periods of braking. The braking resistance could be ~~configured, for example, in the form of~~ a heating coil, with which vehicle components, for example, the transmission oil circuit, are heated optionally by means of corresponding lines containing heat- transferring fluid. Very generally, the electric current generated by the electric drive that can be operated in a generator mode can be converted into mechanical and/or thermodynamic energy and used or stored at another location in the ~~commercial~~ vehicle.

~~In an especially preferred embodiment~~Preferably, the electric components in the torque tube ~~have~~include a controller~~. With the controller,~~ for controlling and regulating the electric drive, optionally the power electronics component, the frequency converter, and/or the braking resistance ~~can be controlled or regulated~~.

In particular, when the vehicle axle system ~~according to the invention~~ is used for a front axle of a ~~commercial~~ vehicle, the vehicle axle could ~~have~~be a ~~steering-type~~steerable axle. In this case, it would be useful to drive the wheels of the rear axle purely mechanically by ~~an internal combustion engine allocated to the commercial~~the vehicle engine and to drive the wheels of the ~~steering-~~steerable type

axle purely electrically. In this way, the wheels of each axle half of the steering- type axle can be controlled in an especially advantageous way with rpm values independent of each other, so that, for example, power steering can be realized, however, without providing a mechanically complicated gear train between the wheels of each axle half.

~~In an especially preferred way~~Preferably, at least one electric interface is provided on the torque tube. With this interface, at least one electric line provided on the vehicle frame and/or on the vehicle axle can be connected to at least one electric line, which is arranged on the torque tube. In this way, the assembly of the ~~commercial~~ vehicle can be simplified in an especially advantageous way, namely, a cable tree does not have to be pulled through the torque tube or laid in the torque tube. Instead, only the connections of the electric interface are to be established, wherein an electric interface could have a plug system, which is preferably embodied so that it can be screwed on and in this way would be secured against unintentional detachment.

For further simplification of the ~~commercial~~ vehicle assembly, but also for simpler retrofitting of already existing ~~commercial~~ vehicles, the electric components in the torque tube could be preassembled in a carrier structure. In this way, the electric components added to the carrier structure would form one module, which can be mounted on or in the torque tube. The carrier structure itself could include, in turn, components of a cooling system, with which the electric components in the torque tube could be cooled.

In ~~an~~a vehicle electric drive system ~~for a commercial vehicle~~, the cooling of the electric components ~~can represent~~is an important aspect of the vehicle design. ~~From this background~~ Accordingly, the surface and/or the walls of the vehicle axle and/or the torque tube could be configured ~~so that~~for cooling of the electric components ~~is possible. This could be achieved in detail in that~~. In particular, the surface and/or the walls of the vehicle axle and/or the torque tube ~~have~~could include cooling fins and/or ~~at least one~~a channel. Preferably, the channel has a ~~meander-like arrangement and can carry, in particular, a flow of coolant. With the~~meandering shape through which coolant flows. With cooling fins on the torque tube or on the vehicle axle, air cooling of the electric components can be performed. With a channel carrying a flow of coolant, for example, water cooling could be realized.

~~The problem named above in terms of a torque tube is solved by the features of Claim 13. Accordingly, a torque tube for supporting axle suspension is connected on one end to a vehicle frame and on the other end to a vehicle axle. The torque tube according to the invention is characterized in that the torque tube can be attached to a vehicle axle system according to one of Claims 1 to 12.~~

~~The problem named above in terms of a vehicle axle is solved by the features of Claim 14. Accordingly, a vehicle axle can be installed on a vehicle so that it can move and is supported preferably so that it can oscillate. At least two wheels are attached to the vehicle axle so that they can rotate. The vehicle axle according to the invention is characterized in that it can be adapted to a vehicle axle system according to one of Claims 1 to 12.~~

~~The problem named above in terms of a vehicle and especially an agricultural or industrial utility vehicle is solved by the features of Claim 15. Accordingly, the vehicle according to the invention is characterized by a vehicle axle system according to one of Claims 1 to 12.~~

~~To avoid repetition, reference is made to the preceding portion of the description.~~

~~Now, there are various possibilities for embodying and improving the teaching the present invention in an advantageous way. Thereto, reference is made, on one hand, to the claims dependent on Claim 1 and, on the other hand, to the following explanation of the preferred embodiments of the invention with reference to the drawing. In connection with the explanation of the preferred embodiments of the invention with reference to the drawing, generally preferred configurations and improvements of the teaching will also be explained. Shown in the drawings in a schematic diagram are~~

~~Figure 1, an embodiment of the present invention in a top view and~~

Brief Description of the Drawings

Fig. 1 is a top view of an embodiment of the present invention; and

~~Figure 2,~~Fig. 2 is a side view of the embodiment ~~from Figure 1 in a side view.~~of Fig. 1.

Description of the Preferred Embodiment

In Figures 1 and 2, an agricultural utility vehicle 10 is shown, wherein identical or similar assemblies are designated with the same reference symbols. The ~~agricultural utility~~ vehicle 10 includes an internal combustion engine 12, which is

attached to the frame 14. The ~~internal combustion~~ engine 12 drives the rear wheels 22, which are allocated to the rear axle 24 of the ~~agricultural utility~~ vehicle 10, via the drive shaft 16 and the automatically switched mechanical gear train 18, as well as the differential transmission 20.

~~The~~A crankshaft generator ~~26, whose~~26 includes a rotor ~~is~~ attached to the drive shaft 16, and is arranged around the drive shaft 16. When the ~~internal combustion~~ engine 12 is operating or when the drive shaft 16 rotates, the crankshaft 26 generates electric alternating current at a frequency dependent on the rpm of the ~~internal combustion~~ engine 12. With the electric energy generated by the crankshaft generator 26, the two wheels 28 are driven by the electric motors 32, which are allocated to the vehicle axle 30 and which are embodied in the form of asynchronous motors. The vehicle axle 30 is embodied in the form of a steering- type front axle of the agricultural utility vehicle 10, namely in the form of a rigid axle. Between the electric motors 32 and the wheels 28 there are gear stages 34 and 36, with which the rpm values of the electric motors 32 are reduced.

The vehicle axle 30 is attached to the frame 14 of the ~~agricultural utility~~ vehicle 10 so that it can move, wherein the vehicle axle 30 is suspended so that it can oscillate. ~~For supporting~~ The torque tube 38 supports the moving or oscillating suspension, ~~there is a torque tube 38, which~~and is attached with one end to the frame 14 and with its other end to the vehicle axle 30.

According to the invention, electric components 40, 42 for the electric drives 32 are provided on or in the torque tube 38. These electric components 40, 42 include a power electronics assembly 40, to which is allocated a frequency converter and a controller for controlling the electric drives 32 ~~and which~~as is shown in ~~Figure 2 as one assembly. As other~~Fig. 2. Other electric components may be mounted in the torque tube 38, ~~there is~~such as braking resistance 42, ~~with which the~~for converting electric energy generated by an electric drive 32 in a generator mode ~~can be converted~~ into heat energy. With this generated heat energy, individual components of the agricultural utility vehicle 10 can be heated~~, wherein the provided~~ by providing heating lines ~~are~~ (not shown ~~for the sake of simplicity.~~).

~~In conclusion it should be noted in particular that the previously explained embodiments are used merely for describing the claimed teaching, which, however, is not limited to these embodiments.~~

While the present invention has been described in conjunction with a specific

embodiment, it is understood that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, this invention is intended to embrace all such alternatives, modifications and variations which fall within the spirit and scope of the appended claims.